



## Mad Roaring Mills: Draft Vegetation Silvicultural Effects Analysis



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## Issues Addressed

Issues pertaining to young, overstocked stands, stand structure classification, and the presence of medium and large diameter trees have been identified for detailed analysis and will be further discussed in subsequent sections of this report.

### Other Resource Concerns

Concern #15: “Treatment Area: Why treat area east and southeast of Pine Flats CG”

Response: The proposed vegetation treatments in this project include both silviculture and fuels treatments. We expect some areas may only need fuels treatments (i.e. prescribed burning), and will be further defined during implementation; such is the case with the area southeast of Pine Flats Campground.

## Methodology

This section includes a description of the methods and data used in this analysis.

The Okanogan-Wenatchee National Forest (OWNF) is implementing a strategic, landscape-scale approach to vegetation management project planning described in the 2012 Forest Restoration Strategy (FRS) with a long-term goal of forests and watersheds that are resilient to disturbances and climate change. For detailed information on the FRS reference the Okanogan-Wenatchee National Forest Restoration Strategy (USDA 2012). A landscape analysis using the Ecosystem Management Decision Support (EMDS) tool helped identify treatment needs and established the context of the project within the broader landscape. The Mad Roaring Mills Project area was analyzed in 2017 and updated in 2019 after the Cougar Creek Fire. The three sub-watersheds included in the potential landscape treatment area (PLTA) are: Lower Mad, Mills Canyon, and Roaring Creek. The reference conditions are based on the Ecological Sub-Region (ESR) that the watershed occurs in (Downing 2017). ESRs are areas of similar climate, geology, topography, and aquatic characteristics, and disturbance regimes. As part of the Interior Columbia Basin Ecosystem Management Project (ICBEMP), Hessburg et al. (1999) determined the Historic Range of Variability (HRV) for ESRs across the OOWNF. Understanding this range gives us a set of reference conditions with which to compare current conditions in sub-watersheds across the Forest. The EMDS analysis displayed the relative departure of existing vegetative conditions to desired conditions, the susceptibility to uncharacteristic wildfire, and the ability to support focal wildlife species.

Departures are identified as values occurring outside of the 80th percentile of historical values (HRV) (Downing 2017). The same thing is done with the Future Range of Variability (FRV). The ‘Desired Condition’ therefore rests in the overlap between the two (Downing 2017). EMDS focuses on landscape-level effects and does not accurately model stand-level dynamics. As such, it was not used to measure the impact of proposed actions on resource indicators. EMDS was used to coarsely model proposed changes in vegetation structure and species dominance. The modeling was conducted by ecologists from the Okanogan Wenatchee National Forest Supervisor’s Office.

### Information Sources

Wenatchee National Forest Land and Resource Management Plan (LRMP) 1990

Northwest Forest Plan (NWFP) 1994

Okanogan-Wenatchee Forest Restoration Strategy (FRS) 2012

- The Okanogan-Wenatchee Forest Restoration Strategy (FRS) (USDA 2012) provides a planning framework, based on principles of landscape-level restoration ecology, to restore the sustainability and resiliency of forested ecosystems on the Okanogan-Wenatchee National Forest. It was developed to provide land managers with the ability to efficiently examine broad Forest landscapes, allowing managers to select high priority areas, design integrated restoration treatments, and consider historical and potential future reference conditions under different climate scenarios. One key premise of the FRS is that maintaining and restoring forest vegetation conditions (structure, composition, and vulnerability to insects) to levels that are within the overlap between historical and future ranges of variability (will provide for more sustainable and resilient forest ecosystems). Forest direction recommends the use of the peer-reviewed FRS to analyze conditions in the Mad Roaring Mills Project area and develop possible restoration treatment options in response to landscape evaluation findings.

### **Incomplete and Unavailable Information**

Stands within the analysis area did not have Region 6 common stand exam (CSE) data collected. Informal field reconnaissance was conducted as a means to inform basic decisions on which stands had a need for treatment.

### **Resource Indicators and Measures**

Stand structure classifications and diameter at breast height (DBH) (Table X1) are the resource indicators and measures used in this analysis to identify the departure from desired conditions.

*Resource Indicator:* Stand Structure Classification

Stand structure is the horizontal and vertical distribution of components of a forest stand including height, diameter, crown layers, and stems of trees, shrubs, herbaceous understory, snags and down woody debris (Helms 1998). Stand structure classifications can be helpful for creating vegetation structures to meet management objectives at the stand level (O'Hara et al. 1996). This analysis uses a six structure classification system (Appendix A)—stand initiation, stem exclusion open canopy, stem exclusion open canopy, understory reinitiation, young forest multi-story, old forest multi-story, old forest single-story—which is not necessarily in sequential development (O'Hara et al. 1996; Hessburg et al. 1999; USDA 2012). Based on the Mad Roaring Mills Landscape Evaluation, the project area currently has an overrepresentation of the stand initiation structure class, compared to desired conditions (Table X1).

*Resource Indicator:* Diameter at Breast Height

Diameter at Breast height (DBH) is a measurement indicator relative to identifying medium and large sized trees that currently exist on the landscape. EMDS identifies medium trees as 16-25 inches DBH and large trees as anything greater than 25 inches DBH. The Forest Restoration Strategy (2012) divides the size classes further by defining large trees as 20-25 inches DBH and very large trees as greater than 25 inches DBH (USDA 2012).

Currently medium to large trees make up 43% of the total overstory within proposed treatment units (Table X2). Although medium to large trees exist on the landscape, the total number is low relative

to the desired future condition. The Mad Roaring Mills Landscape Evaluation identified the desired condition for percent land of medium to large trees as approximately 96% for the Lower Mad sub-watershed, and 89% in both the Mills Canyon and Roaring Creek sub-watersheds (Table X1). The FRS identifies that density objectives for 'large trees' is a minimum of 11 TPA in stem exclusion open canopy (seoc), stem exclusion closed canopy (secc), understory reinitiation (ur), and young forest multi story (yfms) structure classes for dry and mesic plant association groups, which make up the majority of the proposed treatment units (Table X3). When considering only the acres receiving silvicultural treatments (proposed treatment units), the medium and seedling/sapling sized overstory trees make up the largest portions of diameter classes represented in the proposed treatment units, at 40% and 36% respectively (Table X2).

**Table X1.** Current conditions of the stand initiation (si) structure class and presence of medium and large trees within the project area, shown for each sub-watershed (Lower Mad, Mills Canyon, and Roaring Creek). This table is adapted from Mad Roaring Mills Landscape Evaluation.

Vegetation Metric		Current Conditions*	Desired Conditions* (reference overlap)	Total Acres Within Proposed Treatment Units
<i>Ent 103 Lower Mad sub-watershed</i>				
Structure Class (% of landscape)	Stand initiation (si)	49.7	0-20.4	4249
Diameter size (% of landscape)	Medium (16 to 25.0" DBH)	30.67	9.6-57.9	3087
	Large (> 25.0" DBH)	2.92	0.25-37.7	309
<i>Ent 209 Mills Canyon sub-watershed</i>				
Structure Class (% of landscape)	Stand initiation (si)	9	0-17.4	22
Diameter size	Medium (16 to 25.0" DBH)	22.22	3.78-61.0	350
	Large (> 25.0" DBH)	0.90	0.01-28.0	13
<i>Ent 208 Roaring Creek sub-watershed</i>				
Structure Class (% of landscape)	Stand initiation (si)	56.7	0-17.4	842
Diameter size	Medium (16 to 25.0" DBH)	29.76	3.78-61.0	777
	Large (> 25.0" DBH)	0.21	0.01-28.0	30

\* Current Conditions in Table X1 are shown at the project/sub-watershed level

**Table X2.** Current distribution of diameter classes within the proposed treatment units. Diameter classes are taken from EMDS.

<b>OS Size Class</b>	<b>Current Conditions - Total Acres Within Proposed Treatment Units</b>	<b>Current Conditions - Percent of Acres Within Proposed Treatment Units</b>
nonforest/shrubland	397	4%
seedlings and saplings (< 5.0" DBH)	3904	36%
poles (5 to 8.9" DBH)	710	7%
small trees (9 to 15.9" DBH)	1150	11%
medium trees (16 to 25.0" DBH)	4282	40%
large trees (> 25.0" DBH)	352	3%
<b>Total</b>	<b>10795</b>	

**Table X3.** Current conditions of Potential Vegetation Groups (PVG) found within the proposed treatment units. The potential vegetation groups (PVG) shown describe the potential natural vegetation type based on physiographic settings.

<b>Potential Vegetation Groups (PVG)</b>	<b>Current Conditions - Total Acres Within Proposed Treatment Units</b>	<b>Current Conditions - Percent of Acres Within Proposed Treatment Units</b>
Cold forest	1596	15%
Cool shrub	246	2%
Moist forest	1436	69%
Dry forest	7467	<1%
Dry shrub	28	13%
Riparian shrub	21	<1%
Riparian woodland	1	<1%
<b>Total</b>	<b>10795</b>	

## Environmental Consequences

### Existing Conditions and Desired Conditions

The Mad Roaring Mills Landscape Evaluation (Downing 2017), herein called the landscape evaluation, provided a terrestrial summary that provided landscape level information for the IDT. The landscape evaluation identified the following general terrestrial characteristics or trends, found in Table X4. The landscape evaluation document can be found on the project website [http://data.ecosystem-management.org/nepaweb/nepa\\_project\\_exp.php?project=59963](http://data.ecosystem-management.org/nepaweb/nepa_project_exp.php?project=59963)

**Table X4.** General Terrestrial Characteristics And Trends found in The Mad Roaring Mills Landscape Evaluation

ATTRIBUTE	GENERAL CHARACTERISTICS/TRENDS
Physiognomic Type	Mostly forest and woodland, but more herbland/woodland than in reference conditions.
Cover Type	Dominated by Ponderosa Pine, Douglas-fir, and shrubland. These proportions overall are not different from reference conditions.
Structure Class	Dominated by young forest structures: stand initiation and stem exclusion open canopy. There is significantly more stand initiation than in reference conditions.
LOSF	Late Successional forest only makes up a little over 5% of the landscape, but this is not different from reference conditions.
Structure/Cover/PVG	There is more dry forest cover types in stand initiation structures than in reference conditions, also more dry forest shrubland/herbland.
Habitat	There is very little habitat for Northern Spotted Owl or American Marten, but a fair amount of White headed woodpecker habitat. These levels also are within the natural range of variability.
Fire	There is less fuel loading than in reference conditions, and thus a lower risk of crown fire, reflecting how much has burnt already.
Insect/Disease	There is a high risk of Western Spruce Budworm outbreak, but that is also not a departure from reference conditions.

The Mills, Roaring, and Lower Mad watersheds have been impacted by past management activities including cattle grazing, agriculture, timber harvest, wildfire, and road construction. These disturbances have resulted in altered terrestrial ecosystems. As a historically fire prone area, with extensive records dating back to 1902 (Downing 2017), this landscape must be managed to be resilient to future fires to maintain a healthy ecosystem.

The landscape has experienced several recent wildfires in 1970, 1988, 1994, 2014, and 2018 (Downing 2017). The 2018 Cougar Creek Fire burned a total of 14,854 acres within the project area, resulting in a transition from stand initiation to “non-forest”. This stand structure transition reset the post fire recovery after the 1994 Tyee fire. Areas that did not experience high mortality in the 2018 Cougar Creek Fire may be targeted for stand improvement thinning to decrease the fire hazard in the stand and increase diameter growth in the residual trees. Additionally, 327 acres adjacent to these unburned areas are being analyzed for possible stand improvement thinning in the near future. Depending on the growth rate of the trees, these ‘future stand improvement stands’ may be hand thinned in order to take proactive actions and increase the growing space (i.e. space, light, water, nutrients) for the residual trees early on, while also decreasing the fire hazard. Taking active management steps to improve these areas is even more important because of the loss of habitat caused by these repetitive wildfires in the same area.

The proposed treatment units are dominated by fire resistant species such as ponderosa pine (46%) and Douglas-fir (36%). Other species found within the proposed treatment units include Engelmann spruce, subalpine fir, lodgepole pine, western white pine, and the potential for white bark pine.

Structure stages modeled from EMDS are represented in Table X5. The EMDS modeling system projected that the majority of the proposed treatment units are in the stand initiation (si), young forest multi story (yfms), and stem exclusion open canopy (seoc) stages. The stand initiation stage is over represented in comparison to the Historical Range of Variability (HRV) for the project area, as shown in Table X1. Table X5 describes the forest structural classes represented in the proposed treatment units.

The immediate desired condition is one in which stand densities are reduced to allow for an increase in available growing space, improving the health of the residual trees. The long term desired condition is one in which the overrepresented stand structures classes, such as stand initiation, are reduced and the growth of trees is accelerated, resulting in heterogeneity and resiliency to disturbance across the watersheds. Large trees (>20 in DBH) will be favored and represented at a minimum density ranging from 11-17 TPA in both the Dry and Mesic forest types (USDA 2012).

**Table X5.** Current conditions within the proposed treatment units.

<b>Structure Class</b>	<b>Current Conditions - Total Acres Within Proposed Treatment Units</b>	<b>Current Conditions - Percent of Acres Within Proposed Treatment Units</b>
Open Herbland (OH)	90	1%
Closed Herbland (CH)	25	<1%
Closed Low-Medium Shrub (CLS)	62	1%
Open Low-Medium Shrub (OLS)	38	<1%
Open Tall Shrub (OTS)	181	2%
Stand Initiation (SI)	5113	48%
Stem Exclusion Open Canopy (SEOC)	1667	16%
Stem Exclusion Closed Canopy (SECC)	108	1%
Understory Reinitiation (UR)	782	7%
Young Forest Multi Story (YFMS)	2559	24%
Old Forest Multi Story (OFMS)	0	0%
Old Forest Single Story (OFSS)	30	<1%
<b>Total</b>	<b>10795</b>	

## **Environmental Consequences of No Action**

This section discloses the environmental impacts of not taking action.

### **Alternative 1 – No Action**

The No Action Alternative would promote the current conditions and fail to address objectives 1 and 2 of the purpose and need for the proposed project. No reduction in stand density, reduction in wildfire hazard, restorative prescribed burning operations, road improvements, road closures, road decommissioning, stream restoration, or other connected actions would take place. Ongoing and future activities, such as routine road maintenance, recreation use, and noxious weed control would be expected to occur.

The lack of active management would result in a degradation of forest health and an acceleration of disturbance processes, such as, insect outbreaks and catastrophic wildfires. High density stands would remain and/or increase on the landscape, increasing competition between trees, decreasing the presence of understory vegetation, and encouraging the growth of less fire resistant, shade tolerant species; therefore, increasing the potential for wildfire caused mortality. Desired wildlife habitat components, such as, multiple canopy layers, age class variation and/or desired stand structure stages, would not be promoted.

*Resource Indicator:* Stand Structure Classification

Under the No Action Alternative, forest structure and composition would remain fairly homogenous and stand initiation would continue to be overrepresented in the project area for a prolonged amount of time (Table X1). Maintaining the current stand structure would create an area highly susceptible to major disturbances, such as stand replacing wildfire and insect outbreaks.

*Resource Indicator:* Diameter at Breast Height

Diameter growth would be suppressed for medium and large sized trees, as the available growing space would remain limited. Medium and large sized trees could remain sparse or decrease on the landscape (Table X1).

## **Environmental Consequences of the Proposed Action**

This section discloses the environmental impacts of the proposed action.

### **Alternative 2 – Proposed Action**

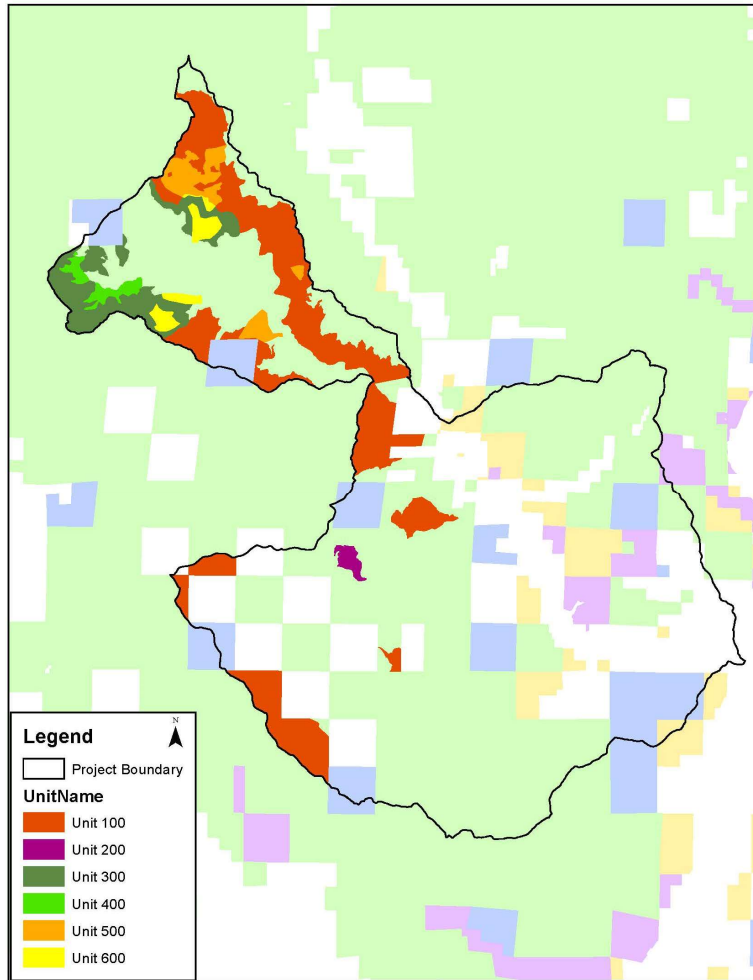
- Non-commercial thin (NCT): This project proposes to reduce stocking with mechanical thinning on approximately 10,654 acres (Table X6, Figure 1). These acres may be cut using chainsaws and hand crews, except 167 acres in Unit 200, where trees may also be cut using ground based equipment. Trees less than 8 inches Diameter at Breast Height (DBH) would be cut within the LSR, while trees less than 11 inches DBH would be cut outside of the LSR. Silvicultural prescriptions (Appendix B) would be written to retain the largest and healthiest trees in the stand. The silvicultural treatments would focus on removing ladder fuels and competition near larger trees that currently exist across the treatment areas, which may also increase the diameter growth rates of residual trees. A portion of residual trees may also be pruned to reduce ladder fuels. Lopping, scattering, handpile burning, as well as prescribed burning outside the LSR, may be used to treat existing and created activity fuels.
- Fuels treatments: On up to 8,133 acres, prescribed fire may be used (Table X6, Figure 1) to restore or maintain the desired fire return intervals and fuel loadings consistent with historical fire

regimes. These treatments would be designed to reduce the potential wildfire intensity by reducing the amount of existing dead and down woody material (<3" diameter). Historically, these stands burned on a frequent basis, this treatment would help return them to their natural fire return interval.

**Table X6.** Summary of vegetation Proposed Action for Alternative 2.

NEPA Unit Number	Total Acres	Land Management Plan	Diameter Limit (DBH)	Method of Tree Removal	Silvicultural Treatments	Fuels Treatments	Potential Vegetation Groups (PVG)
Unit 100	7134	Matrix	<11 in	Hand thin	Stand improvement	Prune, pile burn, underburn	dry forest, moist forest
Unit 200	167	Matrix	<11 in	Hand thin or Ground based mechanical equipment	Stand Improvement	Prune, pile burn, underburn	dry forest, moist forest
Unit 300	1883	LSR	<8 in	Hand thin	Stand improvement	Prune, pile burn	cold forest, dry forest
Unit 400	327	LSR	<8 in	Hand thin	Future stand improvement	Prune, pile burn	cold forest, dry forest
Unit 500	832	Matrix	<11 in	Hand thin	Future stand improvement in planting units	Prune, pile burn, underburn	dry forest
Unit 600	452	LSR	<8 in	Hand thin	Future stand improvement in planting units	Prune, pile burn	dry forest

Each NEPA Unit number in Table X6 represents a variation in the silvicultural treatment. This variation may be based on the maximum diameter size limits, or the current stand conditions which may affect the timeline of treatments. Each NEPA Unit may be subdivided into smaller units with corresponding numbers for implementation. Some NEPA Units have more than one potential vegetation group (PVG) within them, this table shows the two most prominent PVG in each Unit. PVGs in each NEPA Unit may be taken into consideration during implementation unit layout. PVGs may also influence the site specific silvicultural prescription written for each implementation unit, for example, by leaving a higher residual trees per acre in the cold or moist forests, compared to the dry forests.



**Figure 1.** Proposed vegetation treatments shown by NEPA Unit number. Each NEPA Unit number represents a variation in the silvicultural treatment (as explained in Table 6).

## **Direct and Indirect Effects of the Proposed Action**

Direct effects occur at the time and place the action is implemented.

**Direct** effects under the Proposed Action would include reducing stand densities throughout the planning area to meet the desired trees per acre of less than 200 TPA; thus, allocating more growing space to the residual trees. As well as, a reduction in total canopy cover in the understory, resulting in a reduced fire hazard. The Proposed Action would also modify patch sizes and promote spatial variation across the project area. This may decrease the homogeneity of the landscape and improve resiliency to major disturbances such as wildfire and insect outbreaks.

Treatments under the Proposed Action would also maintain fire resistant species ponderosa pine and Douglas-fir. Ponderosa pine and Douglas-fir make up the dominant species within the sub-watersheds, at 46% and 36% respectively. In dry forest types, such as those within the project area, ponderosa pine would be targeted as the preferred dominant species. Ponderosa pine is considered one of the most fire resistant and drought tolerant in comparison to other species identified in the project area. This is due to fire resistant adaptations including thick bark, a high crown, self- and fire-pruned branches, large, protected buds, high foliar moisture content, deep roots, and rapid root growth of seedlings (Hood et al. 2018).

*Resource Indicator:* Diameter at Breast Height

Another direct effect from the Proposed Action would be promoting and protecting the existing medium and large tree component by removing smaller diameter trees from the understory and reducing the existing TPA across the project area. This may provide a portion of the desired habitat components for the northern spotted owl.

Indirect effects occur off-site or later in time.

*Resource Indicator:* Stand Structure Classification

An **indirect** effect under the Proposed Action would be an increase in structural heterogeneity. A reduction in stand density could accelerate the transition from stand initiation to understory reinitiation—including trees, shrubs, and herbaceous vegetation—and eventually to young forest multi story or old growth structure classes.

*Resource Indicator:* Diameter at Breast Height

Other **indirect** effects under the Proposed Action Others include increased diameter growth rates among the residual trees. Intermediate treatments and prescribed fire in young, overstocked stands would modify forest health, structure, and composition. Research shows that lowering stand densities enhances tree growth, reduces competition mortality, and increases stand resiliency to disturbances and climate change (Zhang et al. 2019).

## **Cumulative Effects of the Proposed Action**

### *Past, Present, and Reasonably Foreseeable Actions Relevant to Cumulative Effects Analysis*

Past events and actions with a direct effect to vegetation include wildfire, timber harvest, cattle grazing, road construction, and reforestation. Other previous activities include road building, grazing, invasive weed treatments, and recreational use. The effects of the past actions include, but are not limited to, previous wildfires in the project area impacting the composition and structure—creating areas of early seral species and a homogenous structure; reforestation activities which planted preferred species within wildfire footprints, causing a need to manage the density of competing, less preferred species; soil compaction from mechanized equipment use, causing degradation in the available growing space; recent past activities shown in Figure 2 of the Fuels report.

Ongoing and/or reasonably foreseeable future actions within or adjacent to the project area that are considered as cumulative effects because they would modify forest structure and composition, similar to treatments proposed in this project, include:

- Ongoing maintenance occurring in separate projects that are adjacent to the Mad Roaring Mills project (Figure 2 of Fuels report).
- Road maintenance (blading and brushing along roads)

### *Resource Indicator: Stand Structure Classification*

The **cumulative effects** of the Proposed Action would be a long term, moderate, beneficial impact upon young, overly dense forest stands in the stand initiation structural classification. The non-commercial thinning treatments described above would reduce stand densities in other areas of young, overly dense forest stands adjacent to the project area. These thinning treatments, along with prescribed fire treatments, would help reduce stand densities to improve forest health, build resilience to insect and disease outbreaks, and restore fire on the landscape, helping maintain fuel loadings. Road maintenance would not have a measurable effect on overstocked young forest stands because this action focuses on vegetation brushing and pruning within approximately 5-10 feet from the roadway and would cause little overall change in stand structure, with immeasurable impacts on forest structure and composition.

### *Resource Indicator: Diameter at Breast Height*

The **cumulative effects** of the Proposed Action would be a long term, moderate, beneficial impact on promoting medium and large trees. The thinning treatments described above would be designed to increase the presence of medium and large trees across proposed treatment units, as well as, promote medium and large trees across the landscape. Promoting larger trees across the landscape would help maintain important features for wildlife habitat and provide some resiliency to disturbances. Large diameter ponderosa pine and Douglas-fir are also less susceptible to wildfire caused mortality. Road maintenance would not have a measurable effect on the presence of medium to large trees because this action focuses on vegetation brushing and pruning within approximately 5-10 feet from the roadway, and no medium to large trees would be removed unless they are considered a danger tree.

## **Consistency with Relevant Laws, Regulations, and Policy**

### **Land and Resource Management Plan**

The Entiat Ranger District is managed under the 1990 Wenatchee Forest Plan, as amended by the Northwest Forest Plan (NWFP 1994).

The Wenatchee National Forest Land and Resource Management Plan (LRMP) (USDA 1990) provides standards and guidelines for Timber and Vegetation management projects. See Appendix C for complete descriptions of each standard and guideline directly related to forest vegetation resources.

- Intermediate Harvest (non-commercial thinning for this planning project)
  - Intermediate harvests should be designed to improve quality, vigor and value of the residual stand and not necessarily to maximize return from the intermediate harvest.
- Silvicultural Examination and Prescription
  - The selected silvicultural system must be capable of providing special conditions, such as a continuous canopy or continuous high density live root mats when required by critical soil conditions, or conditions needed to achieve management objectives such as streamside protection, wildlife needs, and visual resources.
  - The selected silvicultural system must permit control of existing or potential vegetation to a degree that establishment of numbers of trees, other desirable vegetation, and rates of growth as identified in site specific silvicultural prescriptions for harvest areas, can be achieved.
  - The silvicultural systems selected must promote stand structure and species composition which avoids serious risk of damage from mammals, insects, disease, or wildfire and will allow treatment of existing insect, disease, or fuel conditions.
  - Silvicultural prescriptions will be prepared on a site specific basis for all activities proposing the management of trees or timber stands to meet resource objectives. All prescriptions will be prepared or approved by a certified silviculturist.
  - The silvicultural prescription shall consider integrated pest management. Pests include insects, diseases, animals, and vegetation.
- Timber Stand Improvement
  - The actual number of trees for satisfactory reforestation may range from 150-500 TPA. Variations depend on species and tree sizes found on site. Stands with more than 500 TPA normally need thinning to optimize growth.
  - Release projects shall be governed by the Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation.

Alternative 2 complies with all relevant laws, regulations, and policies discussed above. It abides by all relevant standards and guidelines from the LRMP of the Wenatchee NF. Specifically Alternative 2 is designed to improve the quality, vigor and value of the residual stand following an intermediate harvest. Alternative 2 will comply with the Silvicultural Examination and Prescription criteria and all treatment prescriptions will be written or approved by a certified silviculturist.

## **Special Area Designations**

### **Inventoried Roadless Area**

The proposed treatment units include 1,748 acres of the Entiat Inventoried Roadless Area (IRA), where trees would be cut, sold, and/or removed to maintain or restore the characteristics of ecosystem composition and structure (36 CFR 294.13(b)(1)(2)) (USDA 2001). Treatments would occur in portions of the IRA where stands have become uncharacteristically dense with understory and overstory vegetation, increasing competition for limited nutrient and water resources. Without active management, these areas are at risk for higher mortality from insects and disease and uncharacteristic wildfire effects such as widespread crown fire. These acres would receive stand improvement treatments, which would help reduce stand densities, provide growing space to create larger, healthier forested stands, and contribute toward maintaining and restoring the composition and structure of the reference landscape (36 CFR 294.11(6)).

## **Other Relevant Law, Regulation, or Policy**

### **Federal Law**

- The National Forest Management Act (NFMA). The NFMA requires that the Forest Service manage fish and wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. NFMA requires assurance that the lands can be adequately restocked within five years after final regeneration harvest (FSM 1921.12g).
- The Multiple-Use, Sustained-Yield Act (MUSY) of 1960 (P.L. 86-517, 74 Stat. 215; 16 U.S.C. 528-531). The MUSY states that the National Forests are to be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. This Act directs the Secretary to manage these resources in the combination that will best meet the needs of the American people; providing for periodic adjustments in use to conform to changing needs and conditions; and harmonious and coordinated management of the resources without impairment of the productivity of the land. Sustained yield means achieving and maintaining into perpetuity a high-level annual or regular periodic output of renewable resources without impairment of the productivity of the land.

### **Executive Orders**

- Promoting Active Management of America's Forests, Rangelands, and other Federal Lands to Improve Conditions and Reduce Wildfire Risk, EO 13855 of December 21, 2018

## **Conclusion**

The Proposed Action alternative would have beneficial, long term effects on forested stands within the project area. The proposed action treatments would improve tree health and vigor, and increase resilience to disturbances, such as wildfire, insects, disease, and drought (Nyland 2002). Treatments would reduce stand densities by removing understory ladder fuels and favoring the largest, healthiest trees. Mechanical thinning, in combination with prescribed fire treatments, would have a pronounced positive effect on forest health, structure, vigor, and species composition (USDA 2012, Schwilk et al. 2009).

**Acronyms**

CSE- Common Stand Exam

DBH (dbh)- Diameter at breast height

EMDS- Ecosystem Management Decision Support

ESR- Ecological Sub Region

FRS- Okanogan Wenatchee Forest Restoration Strategy

FRV- Future Range of Variation

HRV- Historic Range of Variation

IDT- Interdisciplinary Team

IRA- Inventoried Roadless Area

LRMP- Wenatchee National Forest Land and Resource Management Plan

MA- Management Areas

MUSY- Multiple-Use, Sustained-Yield Act

NEPA- National Environmental Policy Act

NFMA- National Forest Management Act

NWFP- Northwest Forest Plan

OFMS- Old Forest Multi Story

OFSS- Old Forest Single Story

PLTA- Potential Landscape Treatment Area

SECC- Stem Exclusion Closed Canopy

SEOC- Stem Exclusion Open Canopy

SI- Stand Initiation

UR- Understory Reinitiation

WUI- Wildland Urban Interface

YFMS- Young Forest Multi Story

## **Glossary**

**Composition:** The proportion of each tree species in a stand expressed as a percentage of the total number, basal area, or volume of all tree species in the stand.

**Cover type:** the plant species forming a plurality of composition across a given area, where plurality means comprising the largest proportion in the stands of mixed composition.

**Disturbance (characteristic and uncharacteristic):** Any relatively discrete event in time that disrupts ecosystems, communities, or population structure and changes resources, substrate availability, or the physical environment (Helms 1998). Characteristic disturbances are those whose extent, frequency, and severity fall within the natural range of variability. Uncharacteristic disturbances are outside the natural range of variability and interrupt characteristic processes and functions.

**Disturbance regime:** the types of disturbances (i.e. fire, storm events, insects, disease, etc.), disturbance timing (season), frequency, predictability, and severity.

**Ecosystem:** A spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and elements of the abiotic environment within its boundaries. An ecosystem is commonly described in terms of its: composition, structure, function and connectivity.

**Future range of variability:** The future range of variability is a concept described by Garner et al. 2008 and provides insights into how systems may adjust to changing climate.

**Historic range of variability:** describes the variability of ecological conditions (e.g., reference compositional and structural conditions) and the spatial and temporal variation in these conditions during a period of time specified to represent characteristic conditions (i.e., conditions relatively unaffected by people) for an ecosystem in a specific geographical area.

**Non-commercial:** Trees of non-commercial size, or trees less than seven inch diameter.

**Overstocked:** Stands in which the growing space is so completely utilized that growth has slowed down and many trees, including dominants, are being suppressed.

**Overstory:** that portion of the trees, in a forest of more than one story, forming the upper or uppermost canopy layer

**Resiliency:** The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

**Seral Stage:** A seral stage is an intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

**Stand:** A contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silviculture reporting and record-keeping. Stand may be analogous to Activity Unit.

**Stand Vigor:** physical strength of a tree or stand.

**Stocking:** The degree to which trees occupy the land, measured by basal area or trees per acre, compared with stocking standards for full utilization of the lands growth potential.

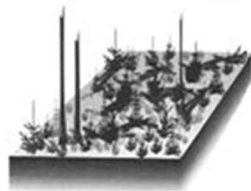
**Understory:** all forest vegetation growing under an overstory

## References Cited

- Downing, T. 2017. Mad Roaring Mills Landscape Evaluation. USDA Forest Service. 5-51.
- Helms, J.A. 1998. The Dictionary of Forestry. The Society of American Foresters.
- Hessburg, P.F.; Smith, B.G.; Kreiter, S.D., Miller, C.A., Salter, B.R., McNicoll, C.H., Hann, W.J. 1999. Historical and current forest and range landscapes in the interior Columbia River basin and portions of the Klamath and Great Basins. Part 1: linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-458. Portland, OR.
- Hood, Sharon; Abrahamson, Ilana; and Cansler, C. Alina. 2018. Fire resistance and regeneration characteristics of Northern Rockies tree species. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer).  
<https://www.fs.fed.us/database/feis/pdfs/other/FireResistRegen.html>.
- Lotan, J.E. and W.B. Critchfield. 1990. R.M. Burns and B.H. Honkala (technical coordinators). Silvics of North America. USDA Agriculture Handbook No. 654, Washington, D.C. 1: 302-315, 416, 523.
- Nyland, R.D. 2002. Silviculture: Concepts and applications. Long Grove, IL: Waveland Press. 395-396.
- O'Hara, K.L.; Latham, P.A.; Hessberg, P.; Smith, B.G. 1996. A Structural Classification for Inland Northwest Forest Vegetation. *Western Journal of Applied Forestry*. (11)3.
- Owens, J.N. 2006. The Reproductive Biology of Lodgepole Pine. Extension Note 07. Forest genetic Council of B.C. 1.
- Schwilk, D.W.; Keeley, J.E.; Knapp, E.E.; Mciver, J.; Bailey, J.D.; Fettig, C.J.; . . . Youngblood, A. 2009. The national Fire and Fire Surrogate study: Effects of fuel reduction methods on forest vegetation structure and fuels. *Ecological Applications*. 19(2): 285-304. doi:10.1890/07-1747.1.  
<https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/07-1747.1>
- USDA and USDI. 1994. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the range of the Northern Spotted Owl (Northwest Forest Plan). USDA Forest Service and USDI Bureau of Land Management. Portland, OR. April 1994. <https://www.fs.fed.us/r6/reo/library/downloads/documents/NWFP-ROD-1994.pdf>
- USDA Forest Service. 1990. Land and Resource Management Plan: Wenatchee National Forest. Pacific Northwest Region.
- USDA Forest Service. 2001. Federal Register: Rules and Regulations. Special Areas; Roadless Area Conservation 36 CFR Part 294. (66)9.
- USDA Forest Service. 2012. The Okanogan-Wenatchee National Forest restoration strategy: adaptive ecosystem management to restore landscape resiliency. Okanogan-Wenatchee National Forest.
- Zhang, J.; Finley, K. A.; Johnson, N.G.; & Ritchie, M.W. 2019. Lowering Stand Density Enhances Resiliency of Ponderosa Pine Forests to Disturbances and Climate Change. *Forest Science*. (65)4: 496-507. [https://www.fs.fed.us/psw/publications/zhang/psw\\_2019\\_zhang005.pdf](https://www.fs.fed.us/psw/publications/zhang/psw_2019_zhang005.pdf)

## Appendix A: Forest Structural Classifications

**Figure 1.** Forest Stand Structure Images and Definitions (O'Hara et al. 1996, Hessburg et al. 1999).



A. Stand Initiation (SI): Growing space is reoccupied following a stand replacing disturbance.



E. Young Forest Multi-Strata (YFMS): Two or more cohorts are present through establishment after periodic disturbances. Large and/or old early seral trees are often at reduced density from fire or logging.



B. Stem Exclusion Open Canopy (SEOC): Below-ground competition limits establishment of new individuals.



F. Old Forest Multi-Strata (OFMS): Two or more cohorts and strata are present including large, old trees.



C. Stem Exclusion Closed Canopy (SECC): New individuals are excluded through light or below-ground competition.



G. Old Forest Single-Strata (OFSS): Single-stratum stands of large, old trees. Relatively few young trees are present in the understory.



D. Understory Reinitiation (UR): Initiation of a new cohort as the older cohort occupies less than full growing space.

## **Appendix B: Silvicultural Prescriptions**

### **Rx1: Small tree thinning**

Small trees will be removed to promote diameter growth of the residual trees, as well as remove ladder fuels, decreasing the fire hazard in the stand.

- Matrix
  - Residual stocking would range between 50 to 200 TPA, only trees less than 11" DBH would be cut, created openings would range from ½ to 1 acre in size.
- LSR
  - Residual stocking would range between 50 to 200 TPA, only trees less than 8" DBH would be cut, created openings would range from ½ to 1 acre in size.

### **Rx2: Small tree thinning in post-fire planting units**

Natural regenerating lodgepole pine less than the stated diameter size, will be removed to reduce competition for the preferred planted species, as well as reduce the fire hazard in the stand.

- Matrix
  - Residual stocking would range between 100 to 200 TPA, only trees less than 11" DBH would be cut, only lodgepole pine would be removed.
- LSR
  - Residual stocking would range between 100 to 200 TPA, only trees less than 8" DBH would be cut, only lodgepole pine would be removed.

### **Rx3: Possible future small tree thinning within the 2018 Cougar Fire**

Site specific identified areas may be thinned in the near future, if necessary, following the metrics in Rx1 once burned stands within the 2018 Cougar Creek Fire surpass a density of 200 TPA—chosen because it exceeds the desired stocking level—or before lodgepole pine has reached reproductive age, between 5-15 years—chosen to reduce competition between lodgepole pine and other conifers which produce viable seed at older ages) (Lotan and Critchfield 1990; Owens 2006).

- Matrix
  - Residual stocking would range between 50 to 200 TPA, only trees less than 11" DBH would be cut, created openings would range from ½ to 1 acre in size.
- LSR
  - Residual stocking would range between 50 to 200 TPA, only trees less than 8" DBH would be cut, created openings would range from ½ to 1 acre in size.

### **Rx4: Fuels treatments**

Thinned stands may receive fuels treatments to reduce the presence of hazardous fuels and restore the health of the stand. Scientific literature has shown that combining thinning and fuels treatments results in more fire resistant stands compared to thinning or burning alone.

- Matrix/LSR
  - After thinning is complete, stands may be prescribed and/or pile burned. Acceptable mortality ranges will be determined on a unit by unit basis and will be written in the site specific silvicultural prescription.

## **Appendix C: Wenatchee Forest Plan Desired Future Conditions**

**These forest-wide desired future conditions pertain to vegetation treatments** (for all of the forest-wide desired future conditions, please reference the Wenatchee Forest Plan Appendix F, pages F1-F61):

### **ISSUE: BIODIVERSITY**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Maintain native and desirable introduced or historic plant and animal species and communities. Provide all seral stages of all plant associations in a distribution and abundance to assure species diversity and ability. A desired future condition is to establish the local needs of management indicator species, rare species, and the proportion of seral stages that allows for natural diversity.

### **ISSUE: OLD GROWTH ECOSYSTEMS**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Maintain old growth forest ecosystems as needed for plant habitat, esthetics and biological diversity while still providing appropriate levels of timber for commodity use.

### **ISSUE: TIMBER OFFERED) (Allowable Sale Quantity [ASQ] and Timber Sale Program Quantity [TSPQ])**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Achieve planned and assumed volumes of timber sold annually and for the planning period in ASQ and TSPQ.

### **ISSUE: TIMBER HARVEST UNITS (Size, shape and location)**

FOREST GOALS, DESIRED FUTURE CONDITION, *OUTPUTS*. Manage vegetative cover to meet direction on size of openings created by National Forest timber harvest.

### **ISSUE: TIMBER HAREST**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Ensure that regeneration harvests are not prescribed for areas where average annual growth has not generally reached culmination of mean annual increment.

### **ISSUE: SILVICULTURAL PRACTICES**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Assure that silvicultural prescriptions are appropriate, effective and consistent with resource objectives for each management area.

### **ISSUE: INSECT AND DISEASE CONTROL**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS. Assure that management practices do not contribute to increases in the incidence of destructive insects and diseases such as spruce budworm, Douglas-fir tussock moth, pine beetle, mistletoe, root rots, and others.

### **ISSUE: FOREST FIRE PROTECTION**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Provide protection from wildfire for forest users, improvements, and forest resources in an efficient manner.

### **ISSUE: USE OF PRESCRIBED FIRE**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Appropriate, efficient application of prescribed fire in support of the Forest Management program.

### **ISSUE: COMMUNITY EFFECTS**

FOREST GOALS, DESIRED FUTURE CONDITION, OUTPUTS: Provide local communities with a constant source of opportunity for the use of goods and services that provide for desired community growth. Changes in the kinds of business opportunities available today are likely over time.

**Management Area (MA) specific goals:**

- **MA General Forest (GF):** The goal is to provide for long-term growth and production of commercially valuable wood products at a high level of investment in silvicultural practices.
  - Future stands will vary from intensive timber management typified by regular spacing, relatively even age and height, to those that are similar to natural stands. The cultural practices will be determined on a site specific basis depending on the biological and economic conditions of the stand. In the General Forest area, the relative intensity of management is set by the Forest Plan. However, site specific details and locations of treatments will be determined in the prescription written or field reviewed by a certified silviculturist.
  - S&G: Use methods compatible with the goal.
  - Management Practices: 1. Release regeneration overtopped by competing vegetation. 2. Fertilization will be used where it is cost effective, and on soils where increased growth of conifers can be expected based on past experience or research.
- **MA Old-Growth Habitat, Dedicated (OG1):** The goal is to manage for old growth habitat to achieve “ecosystem diversity, preservation of aesthetic qualities”, and/or wildlife and plant habitat”.
  - The Regional Guide for the Pacific Northwest Region directs all Forests to use a standard definition of old growth. Following are the descriptions of the characteristics needed to meet the requirements of this prescription.
    1. **ECOSYSTEM DIVERSITY:** Ecosystem diversity is a representation of the variety that exists in biotic communities and is characterized by the number of species on a site and by the number of communities at all sites. The variety of management prescriptions will provide many and varied stand conditions and species, helping to maintain ecosystem diversity in managed, younger stands. However, enough of all types of old growth are required to maintain species dependent on old growth and preserve the various kinds of old growth communities found on the Forest.
    2. **PRESERVATION OF AESTHETIC QUALITIES** People using the forest for recreation purposes enjoy old growth trees for their aesthetic and awe-inspiring qualities. Old trees represent a living link with the past and provide an important visual reference to the natural successional process of the forest environment.

Old growth stands are typically thought of as having an atmosphere that is peaceful, cathedrallike, and park-like or an atmosphere of being small, closed in, dominated and encompassed. The stand feels cool and refreshing, and smells musty from the decaying vegetation (rotting logs, snags, fruiting bodies of fungus and underbrush). The trees have deep furrowed bark, large diameters at the base of the tree (generally 21” in diameter or larger), tall and straight boles, (over 100 feet tall) rotten cracks, broken limbs, mosses, lichens, and rounded tops that create the illusion of being old.
    3. **WILDLIFE AND PLANT HABITAT** The indicator species for old growth and mature habitat is the spotted owl. Habitat for spotted owls includes mature and overmature trees dominant in the overstory, a multi-layered canopy, trees of several age classes, large amounts of standing dead trees and down material present, canopy crown closure of 45 percent or greater, and elevations between 1500 and 5000 feet. The 2200 acres (more or less depending upon local circumstances) of suitable habitat

may be contiguous, or scattered over an area of about 9000 acres. There is usually unsuitable habitat (either naturally occurring or from harvest) intermingled with the suitable habitat. It is common to find logging activities next to suitable spotted owl habitat. Road use and recreation activities will often be taking place within the habitat site.

Maintenance of reproduction of spotted owls is of high concern. Therefore, limit activities that may affect reproduction will be limited.

- S&G: 1. None planned, any timber stand improvement projects should enhance old growth condition.
  - Management Practices: N/A
- **MA Dispersed Recreation, Unroaded Motorized (w/o 4x4 routes) (RE2A):** The goal is to provide dispersed, unroaded recreation in a semi-primitive motorized recreation opportunity setting.
  - This prescription is for application to unroaded areas in which trails are evident and maintained for the following types of uses: RE-2A - Areas having existing or potential trails for motorbikes, hikers, and horseback riders. They are generally located in a natural appearing landscape setting. Winter motorized use is permitted where appropriate.
  - S&G: 1. No precommercial thinning.
    - Note: Integrated Pest Management strategies may be used to prevent unacceptable pest damage and meet resource objectives, and treatment of both activity generated and natural fuels is deemed appropriate when coordinated with the recreation management objectives of the area (USDA 1990). Based on these standards and guidelines, thinning activities may only occur in RE-2A if it is deemed necessary to meet either of these objectives.
  - Management Practices: N/A
- **MA Scenic Travel – Retention (ST-1):** The goal is to retain or enhance the viewing and recreation experiences along scenic travel routes.
  - Development and permitted uses will meet the “Retention” Visual Quality Objective in foreground and middle ground areas viewed from recreation sites, and designated roads and trails. Developments and management activities within the allocation generally are not visually evident. The natural existing or established landscape will generally have vegetation on forested lands that is composed of large old growth trees in the overstory or in groves intermixed with a variety of age classes in the understory. The general perception of the landscape is that of a natural appearing environment.
  - S&G: 1. Use methods compatible with the goal.
  - Management Practices: 1. Release regeneration overtopped by competing vegetation. 2. Fertilization will be used where needed to meet the objectives of this management.
- **Management Area Scenic Travel - Partial Retention (ST-2):** The goal is to provide a near natural appearing foreground and middle ground along scenic travel corridors.

- Development and permitted uses will meet the “Partial Retention” Visual Quality Objective in the foreground and middle ground viewed from developed recreation sites and designated roads and trails. The foreground of the main use routes will generally have vegetation that is composed of some large trees in the overstory or in groves intermixed with a variety of age classes in the understory. The middle ground viewed areas from the main travel routes will generally have the perception of a natural appearing environment. The proposed uses and vegetation management within the allocation will be integrated with the natural landscape so that activities are visually subordinate to the characteristic landscape.
- S&G: 1. Use methods compatible with the goal.
- Management Practices: 1. Release regeneration overtopped by competing vegetation. 2. Fertilization will be used where needed to meet objectives of the management prescription.